International Journal of Electrical and Electronics Research ISSN 2348-6988 (online)
Vol. 7, Issue 3, pp: (42-51), Month: July - September 2019, Available at: www.researchpublish.com

DESIGN AND CONSTRUCTION OF 33/11 KV SUB STATION WITH SAFETY AND REDUCTION OF LOSSES

[1]Ramendra kumar vimal, [2]Mr. Joginder Singh

[1] M.Tech, Department of Electrical Engineering, Ganga Institute of Technology and Management, Jhajjar Haryana (India)
[2]Ass prof, Department of Electrical Engineering, Ganga Institute of Technology and Management, Jhajjar Haryana (India)

Abstract: **The thesis deals with the analysis of Construction of Power Lines and Substation Switchyard of 33/11 KV. In today's life electricity plays a very important role. The demand of electricity is being increased day by day. Therefore many new projects are being introduced not only in town as well as in remote areas also to provide the facilities of electricity by making new transmission lines and Switchyard. In which we will try to know how to build a powerhouse in efficient way and provide an electricity to consumer at low cost and all should be correct in terms of security and safety also.**

While creating a new 33/11 kv sub station it is important to remember few points like construction of 33 kv line with suitable path and and construction of switchyard with better place and distance of villages where power is to be supply with 11 kv line.This thesis is based on analysis and study in unnao district at sohramau 33/11 kv sub station under MVVNL in UPPCL.

Keywords: **electricity, Power Lines, Substation Switchyard, projects.**

1. INTRODUCTION

In india electricty is generated generally at 11 kv voltage and step-up it upto 440/220 kv etc. for transmission purpose because it impossible to generate electricity at any where,So transmission is needed . In long transmission various type of losses are occur, if we transmit generated voltage like 11 kv for example 200 to 500 km so it is impossible to receiving voltage would be usable.so first we step up then transmit and detail are described below.

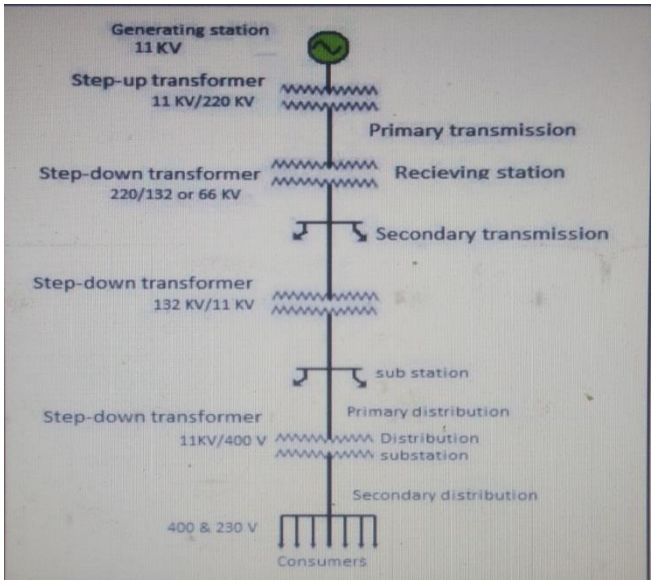

Fig 1: show line digram of generation to distribution of electricity

❖ Generating station**:-** Electrical power is produced in generating station. which are far away from the consumer or load center. there is large network of line conductor between generating station and consumer .energy is generated by different methods which are following as Thermal power station,Hydro power station, Nuclear power station, Diesel power station, Wind power station, and Solar power station. Generating power capacity of generating station is 11KV due to form factor. By using step-up transformer 11KV is step-up into 220KV.

❖ Transmission line**:-** By using transmission line Electrical power is transmit at one end to other end. Here transmission line is connected between generating station to receiving station. its known as primary transmission line. voltage rating of transmission line is high about 220KV. which is step-up by using transformer.

❖ Receiving station**:-** Primary transmission line is connected to the receiving station. transmission line voltage is about 220KV which is step-down to 132KV or 66KV using step-down transformer and that voltage is supply to the substation through the transmission line its known as secondary transmission line.

❖ Substation**:-** The secondary transmission line is connected to substation. Voltage rating of secondary transmission line is 132KV or 66KV which is step-down to the 11KV by using step-down transformer. This 11KV is deliver to the distribution station.

❖ Distribution station**:-** The system by which electrical power is deliver to the consumer from the substation is called Distribution line. 11KV which is deliver by substation is directly given to the HT(high tension) consumer like industrial area. that line known as a primary distribution line. Electrical power from primary distribution line is deliver to the various station. its called distribution station. the distribution station is located near to the consumer area. and the voltage is step down 11KV to 400v or 230V by Transformer. that voltage is deliver to the consumer or load center that known as secondary distribution line. Secondary distribution system is 3 phase ,4 wire system.

❖ Consumer**:-** Secondary distribution line is deliver power to the consumer. the voltage rating is 400V or 230V. 400V is used for the industries or commercial load. It is 3 phase , 4 wire system. 230V is used for the domestic load. It is single phase, 2 wire system.

2. 33/11 KV SUBSTATION

There are three main part of substation-

A-33 kv line.

B-Switchyard and control room.

C-11 kv line.

A- 33 KV LINE :-

33 kv line is incoming line on the 33/11 kv sub station it is further step down at 11 kv with the help of step-down transformer at the sub-station. And transmit it with the 11 kv feeder to the village or consumer. It is important to survey first where we want to make line it is first stage for working . If we have proper survey where we will construct a line the it will reduce the time and right of way issue. In 33 kv line various major material is used .

- Pole
- Conductor
- Pin insulator and disc insulator
- V cross arm

B- Switchyard and control room of step down sub-station :-

Switchyard- It is the arrangement of all equipment which are used for proper operation of sub-station where step-down transformer is installed. These all equipment are erect on the foundation of concrete cement and sand, in specified area is known as switchyard. And few equipment are connected to control panel which are install in control room with the help of control cable. Fig shows the line diagram of equipment arranged in switchyard.

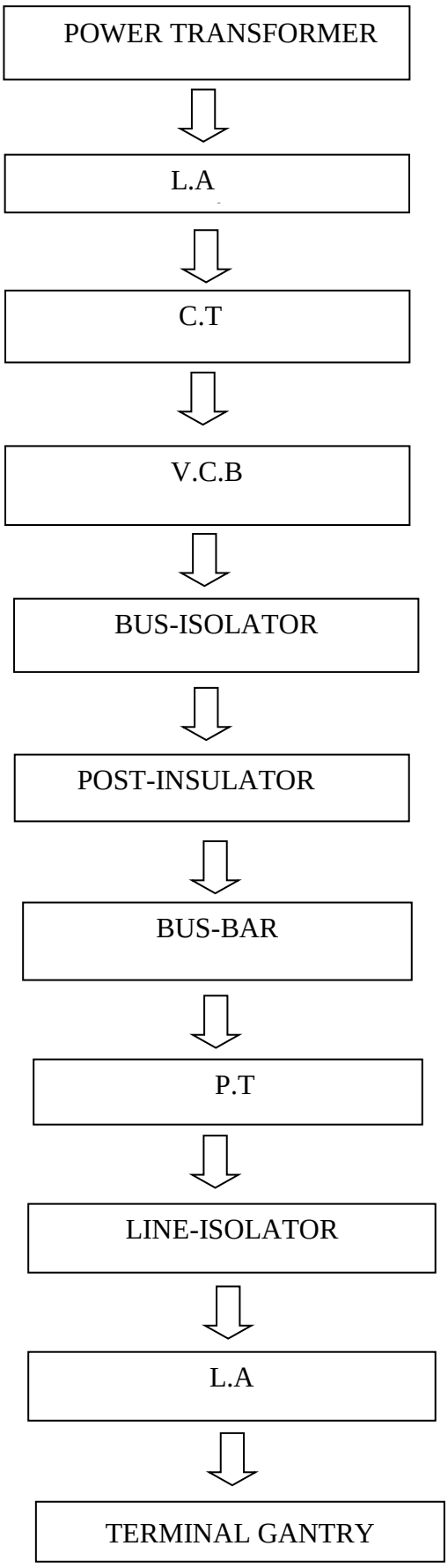

Fig 2: Switchyard Equipment's

❖ **Power Transformer.**

A transformer is a four-terminal device that transforms an AC input voltage into a higher or lower AC output voltage. It transforms power from a particular circuit to another with no frequency changes regardless of the voltage levels. The transformer consists of three main components: primary winding, which acts as an input, the second coil secondary winding, which acts as the output, and the iron core, which serves to strengthen the magnetic field generated. Transformer has no internal moving parts, and it transfers energy from one circuit to another by electromagnetic induction. External cooling may include heat exchangers, radiators, fans, and oil pumps. Transformers typically used because a change in voltage is needed. Power transformers are defined as transformers rated 500 kVA and larger (In figure 3 is shown typical power transformer of 5 MVA).[1]

Figure:3 shows Power Transformers transfer electrical energy between two circuits completely insulated from each other and this allows high voltage to low voltage (step-down transformer). Higher voltage and lower current reduce the required size and cost of transmission lines and reduce transmission losses. They do not require, as much attention as most other devices; nevertheless, the care and maintenance, which they really require, is absolutely necessary. Because of their reliability, maintenance is sometimes ignored, which reduces service life and sometimes outright failure.

Principle of operation-The function of the transformer is based on the principle that electrical energy is transferred efficiently by magnetic induction from one circuit to another. When one winding of the transformer is energized from an AC source, an alternating magnetic field is installed in the transformer core. Alternating magnetic lines of force, which circulate through the core, are called “flux”. With a second winding around the same core, voltage is induced by the alternating flux lines. A circuit, connected to the terminals of the second winding, results in current flow. Each phase of a transformer consists of two separate coil windings, wound on a common core. The low-voltage winding is located closer to the core; the high-voltage winding is then placed around the low voltage winding and core. The core is usually made from very thin steel laminations, each of which is covered with insulation. Isolation between individual laminations reduces losses. The steel core provides a low resistance path for magnetic flux. High-voltage and low-voltage windings are isolated from the core and from each other, and leads are brought out through insulating bushings. A three-phase 4 transformer typically has a core with three legs and has around each leg both high-voltage and low-voltage windings. For insulation and internal structural support are used special paper and wood[1]

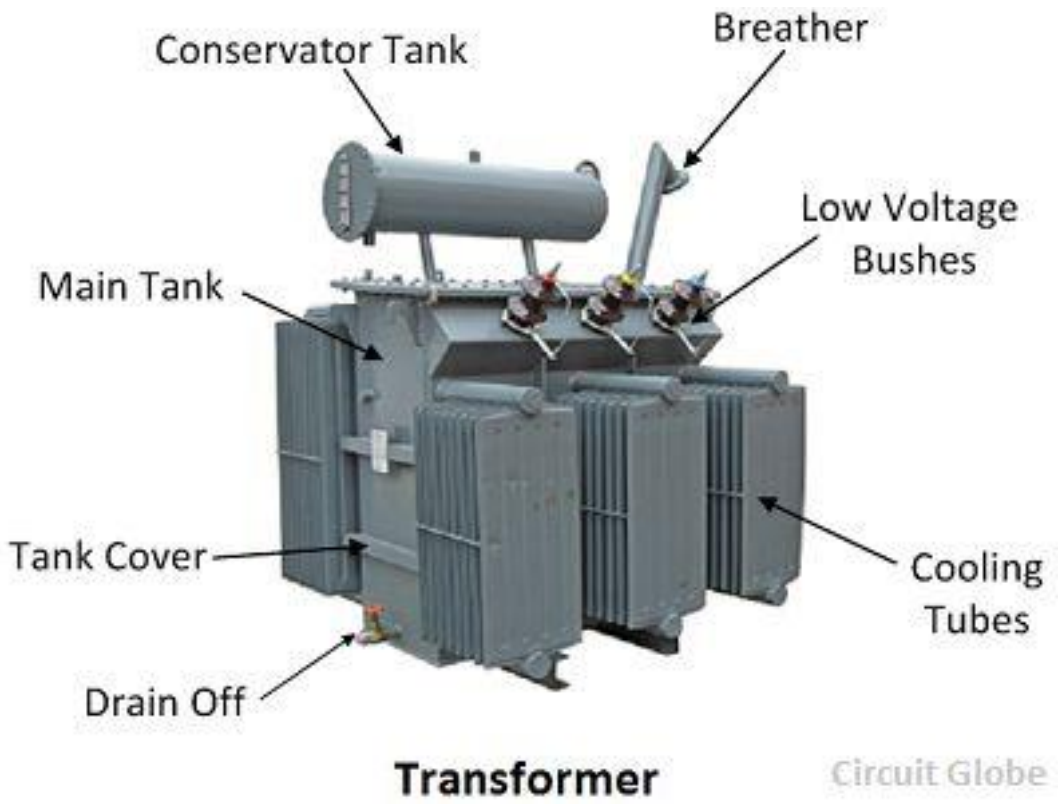

Fig 3: shows the main part of transformer

Fig 4: Power transformer

❖ **Lightning arrester:-**

A **lightning arrester** (alternative spelling **lightning arrestor**) (also called **lightning diverter**) is a device used on electric power systems and telecommunication systems to protect the insulation and conductors of the system from the damaging effects of lightning. The typical lightning arrester has a high-voltage terminal and a ground terminal. When a lightning surge (or switching surge, which is very similar) travels along the power line to the arrester, the current from the surge is diverted through the arrester, in most cases to earth.[2]

❖ **Current transformer:-**

A current transformer (CT) is a type of transformer that is used to reduce or multiply an alternating current (AC). It produces a current in its secondary which is proportional to the current in its primary. Current transformers, along with voltage or potential transformers, are instrumenttransformers.[2]

❖ **Vacuum Circuit Breaker:-**

VCB stands for Vacuum Circuit Breaker. In vacuum circuit breakers, the vacuum is used as the arc quenching medium.

Fig 5: internal structure of VCB

Vacuum offers the highest insulating strength. So it has far superior arc quenching properties than any other medium (oil in oil CB SF6 in SF6 Circuit Breaker).

For example, when contacts of a breaker are opened in the vacuum, the interruption occurs at first current zero with dielectric strength between the contacts building up at a rate thousands of times higher than that obtained with

Other type of circuit breaker.

The production of arc in a vacuum circuit breaker and its extinction can be explained as follows :

When the contacts of the breaker are opened in the vacuum (10^-7 to 10^-5 torr), an arc is produced between the contacts by the ionization of metal vapors of contacts.

However, the arc is quickly extinguished because the metallic vapors, electrons, and ions produced during arc rapidly condense on the surfaces of the circuit breaker contacts, resulting in a quick recovery of dielectric strength.

The salient feature of vacuum as an arc quenching medium is that as soon as the arc is produced in the vacuum, it is quickly extinguished due to the fast rate of recovery of dielectric strength in the vacuum.[2]

❖ **Isolator :-**

which is commonly known as **isolator** or **disconnector** is a piece of equipment that is used in electric devices and power systems with the main function of effectively isolating two different parts of an instrument. By definition, isolation is the process of complete separation of various parts of an apparatus and this separation can either be physical or electrical or both.fig shows below

Fig 6: Isolator

❖ **Bus Bar :-**

Bus bar In other words, it is a type of electrical junction in which all the incoming and outgoing electrical current meets. Thus, the electrical **bus bar** collects the electric power at one location. The **bus bar** system consists the isolator and the circuit breake.

Fig 7: Bus bar at sub station.

❖ **Potential Transformer:-**

The potential transformer may be defined as an instrument transformer used for the transformation of voltage from a higher value to the lower value. This transformer step down the voltage to a safe limit value which can be easily measured by the ordinary low voltage instrument like a voltmeter, wattmeter and watt-hour meters, etc.

Fig 8: Potential transformer

❖ **Terminal gantry:-**

Gantry tower is a structure commonly found in electrical substation or transmission line. It is a combination of two or more legs (towers) and an overhead beam. To the overhead beam a lifting device is connected. Gantries can be constructed to meet the specific requirements of the location. As they can only lift vertically, versatility is limited and they need to be built over the foundation.

Below fig shows terminal gantry used in sub station.

Fig 9: Terminal gantry

Single line digram

The single line diagram (SLD) is the most basic of the set of diagrams that are used to document the electrical functionality of the substation.Typically, single line or one line diagrams are used to document the configuration of the electrical high voltage circuit of substation. This line digram is based on above switchyard discussion.

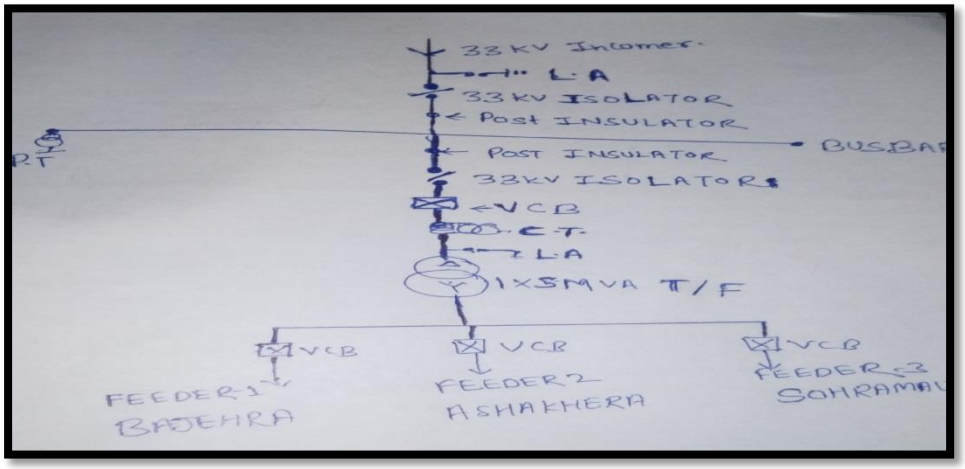

Fig 10: Line digram of sub-station

Control room- Control room is a building or room at sub-station where all controlling panel is install for safety operation. Like transformer panel, bus coupler, incoming and out going panel ,battery bank, these all panel are install in the control room and are operated by an operator.

Control panel

Control relay Transformer panel

Battery bank

Fig 11: Snap of installed equipment in the control room

C- 11 KV LINE :-

11 kv line is the out going feeder from the sub station for provide the electricity to the village. The major item is used in the line is pole, conductor, v-cross arm , pin and disc insulator, stay insulator. the overhead line is erect from sub station to the village at the distribution transformer, like 10 kva,16 kva,25 kva, 63 kva etc. for step down 440 to 220 volt for consumption. Fig is shown below.

Fig 12: Distribution transformer

In above figure shown one side is 11 kv incoming and other side out-going which is 440/220 volt for consumer for domestic purpose , with the help of 3 phase ABC or single phase ABC. After from ABC cable service cable is connected and provide electricity to consumer single phase or three phase energy meter as shown below.

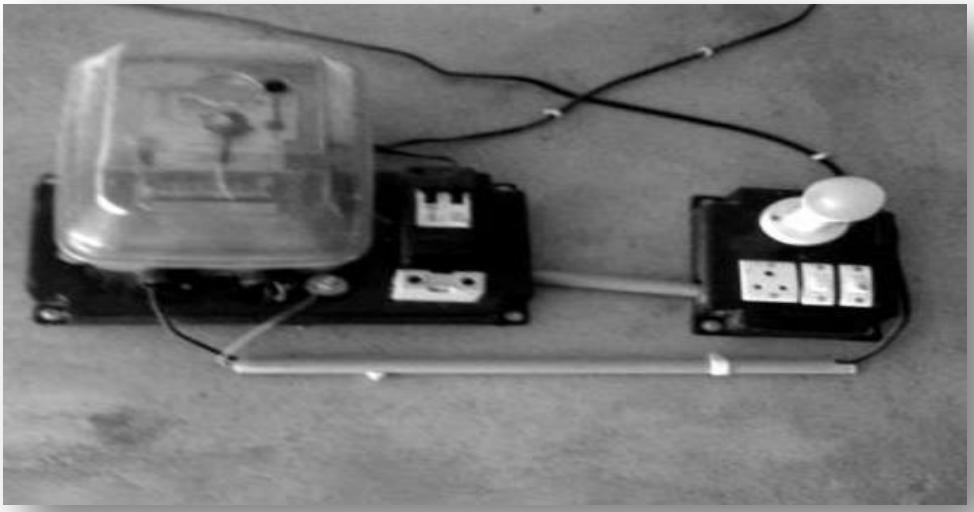

Fig 13: single phase energy meter.

REFERENCES

Mostly above study is based on the REC guideline.

[1] Power Transformers in Electrical Transmission and Distribution Grids written by Aidana Ibatullayeva.

[2] Wikipedia